

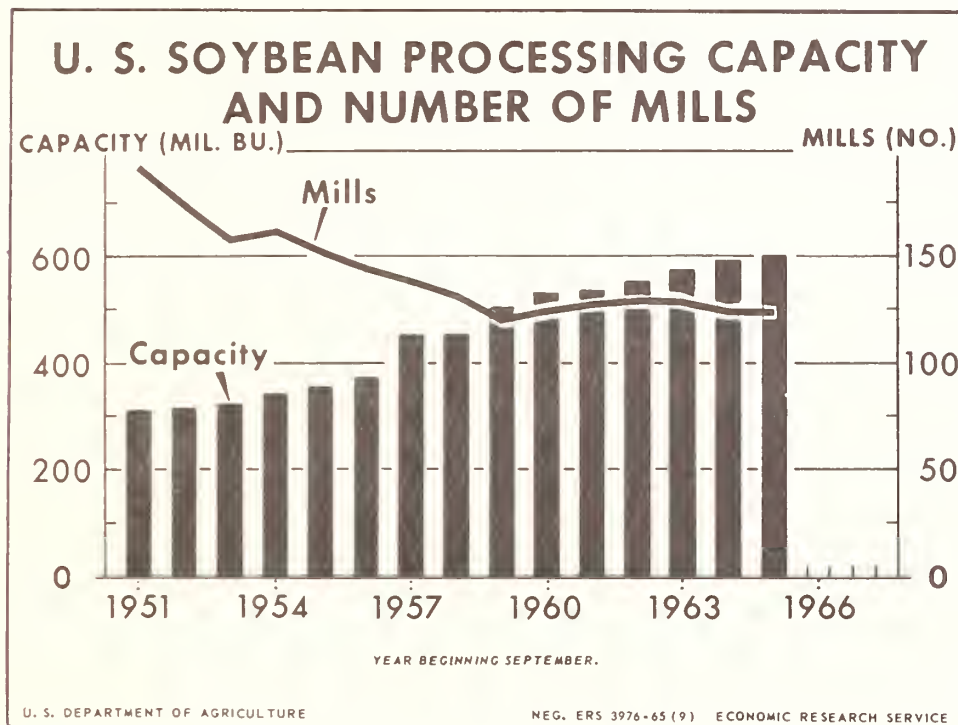
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GROWTH IN U. S. SOYBEAN PROCESSING CAPACITY

by

George W. Kromer



U. S. soybean processing capacity has about doubled during the past 15 years, increasing from 310 million bushels in 1951 to about 600 million in 1965. However, the rate of expansion has slowed considerably in recent years. Meanwhile, the number of mills processing soybeans dropped from 193 to 124

and the average mill size increased. Since 1958, however, the number of mills has leveled off, varying between 121 and 128 annually. Processing capacity has exceeded actual crushings by about 20 percent despite the sharp uptrend in soybean production and the reduction in mills. (See page 43).

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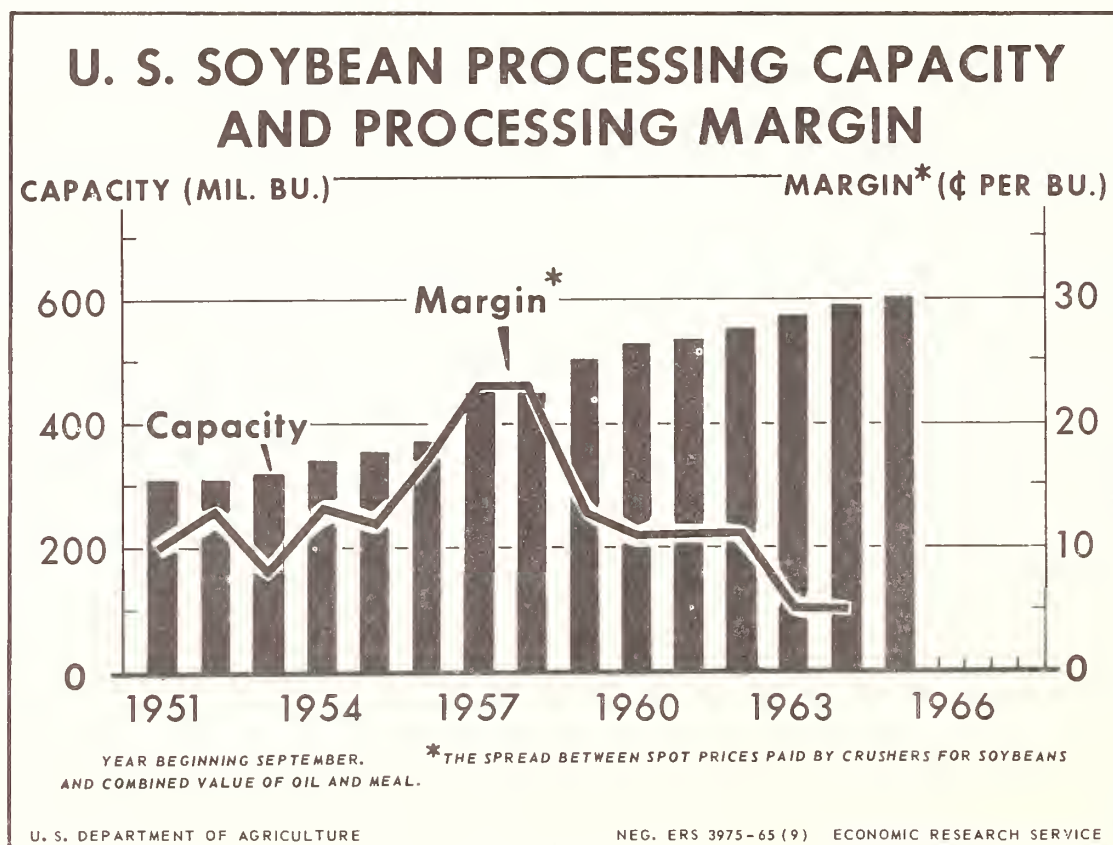
GROWTH IN U. S. SOYBEAN PROCESSING CAPACITY

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The U. S. soybean processing industry has increased its plant capacity rapidly in recent years along with the sharp growth in soybean production and rapidly expanding market outlets for soybean oil and meal. Since 1951, soybean processing capacity has approximately doubled, rising from 310 million bushels that year to about 600 million estimated for 1965. ^{1/} However, the rate of expansion of soybean mills as such has slowed considerably in recent years. (See cover chart). Meanwhile with the expansion of soybean production in the South, more cottonseed mills--including several efficient solvent extraction mills--are crushing soybeans during part of the year. Since 1951, the number of mills processing soybeans dropped sharply from 193 to 124 but the average mill size increased (table 30). Since 1958, however, the number of mills has leveled off, varying between 121 and 128 annually.

^{1/} Estimates of soybean processing capacity for 1951, 1956, and 1957 were developed from Census data, based on the "peak" month crush for individual mills. Capacity estimates for 1958-65 (except 1961) are from trade sources. Estimates for gaps in the series are based on USDA interpolations.



Processing capacity has exceeded the volume crushed despite the sharp upward trend in soybean production and the steady reduction in the number of mills. The excess capacity results primarily from 2 factors: Building of larger and more efficient mills, and enlargement of facilities of active mills. These changes occurred as plants shifted from older mechanical methods of crushing soybeans to solvent processing. In addition, plants can now efficiently process more than 1 type of oilseed and thereby have greater operational versatility throughout the year. With the construction of large solvent extraction mills and the advent of the horizontally integrated processor (mixed feed-crushing operation), processors' margins were generally reduced from 27 cents per bushel in 1950 to only 7 cents for the industry as a whole in 1964. ^{1/} However, processing margins during September-October 1965, the first 2 months of the current marketing year, improved averaging 50 cents per bushel. Solvent extraction is the more efficient processing technique and now accounts for over 95 percent of all soybeans processed in this country.

Soybean oil and soybean meal are joint products obtained simultaneously during the processing operation in relatively constant physical proportions. A 60-pound bushel of soybeans yield on the average about 11 pounds of crude oil and 47-48 pounds of meal. Soybeans are low in oil content and high in protein as compared with other oil-bearing materials. Soybean meal outturn per unit processed runs about 79 percent, linseed meal 66 percent, cottonseed 47 percent, peanuts (farmers' stock) 43 percent, and copra 35 percent. Thus, soybeans have a unique advantage over other oilseeds as a source for protein.

Although more meal than oil results from processing a bushel of soybeans, a pound of oil usually brings more than 3 times the price of a pound of meal. Since the early 1950's the value of meal (yield times price) has contributed about 55 percent to the total value and oil 45 percent. In most other oilseed crops, the meal usually represents a smaller percentage of total value than does the oil.

Table 31 shows the yields and values of oil and meal per bushel of soybeans processed and table 32 the percentage distribution of these values since 1953.

All soybean, soybean oil and meal data presented in this article are for the marketing year beginning September 1.

Processing Plants Operate Around 80 Percent of Capacity

Since 1951, soybean crushings have increased in about the same proportion as processing capacity. Crushings in 1951 amounted to 244 million bushels compared with the forecast of 515 million bushels for 1965. As mentioned

^{1/} Processors' margins as used here represent the spread between the price paid by crushers for soybeans and the combined value of soybean products (oil and meal). This calculation is based on simple averages of monthly cash prices as shown in table 31.

Table 30.--Estimated number of soybean oil mills and processing capacity in the United States, 1951-65

Year beginning September	Process- ing mills 1/	Processing capacity				Average per mill	
		Total	Utilized	Excess	Ratio	Processing	Capacity
		2/	3/	4/	of utilized to total	Capacity	utilized
		Number	Mil. bu.	Mil. bu.	Pct.	Mil. bu.	Mil. bu.
1951	193	310	244	66	79	1.6	1.3
1952	174	(315)	234	81	74	1.8	1.3
1953	159	(320)	218	102	68	2.0	1.4
1954	162	(340)	241	99	71	2.1	1.5
1955	152	(355)	282	73	79	2.3	1.9
1956	144	370	314	56	85	2.6	2.2
1957	139	450	351	99	78	3.2	2.5
1958	130	450	399	51	89	3.5	3.1
1959	121	500	394	106	79	4.1	3.2
1960	123	525	406	119	77	4.3	3.3
1961	126	(535)	431	104	81	4.2	3.4
1962	128	550	473	77	86	4.3	3.7
1963	127	575	437	138	76	4.5	3.4
1964	123	585	479	106	82	4.8	3.9
1965	124	600	5/515	85	86	4.8	4.2

1/ Estimates developed from Census data and trade directories. Includes cottonseed and other oilseed mills that process significant quantities of soybeans.

2/ Trade estimates 1958 to date (except 1961). Data in brackets are USDA interpolations.

3/ Soybeans actually crushed.

4/ Difference between total capacity and soybeans utilized (crushed).

5/ Forecast.

Table 31.--Soybeans: Value of products per bushel of soybeans processed and price spread, 1947-64

Year begin- ning September	Value of Products Per Bushel							Soybean price		Spread between value of products and soybean price	
	Soybean Oil			Soybean Meal			Total Value				
	Yield	Price 1/	Value	Yield	Price 1/	Value					
								Received by farmers	No. 1 yellow, Illinois points	Received by farmers	No. 1 yellow, Illinois points
	Pounds	Cents	Dollars	Pounds	Cents	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
1947	9.5	23.4	2.22	47.5	4.15	1.97	4.19	3.33	3.69	.86	.50
1948	9.8	14.0	1.37	47.2	3.29	1.55	2.92	2.27	2.41	.65	.51
1949	9.9	12.0	1.19	46.9	3.28	1.54	2.73	2.16	2.50	.57	.23
1950	9.7	17.9	1.74	46.8	3.16	1.48	3.22	2.47	2.95	.75	.27
1951	10.0	11.6	1.16	46.7	4.07	1.90	3.06	2.73	2.96	.33	.10
1952	10.8	12.0	1.30	47.3	3.52	1.66	2.96	2.72	2.83	.24	.13
1953	11.0	13.4	1.47	47.4	3.90	1.85	3.32	2.72	3.24	.60	.08
1954	10.9	12.2	1.33	45.9	3.06	1.40	2.73	2.46	2.60	.27	.13
1955	11.1	12.5	1.39	46.2	2.68	1.24	2.63	2.22	2.51	.41	.12
1956	10.9	12.7	1.38	47.5	2.36	1.12	2.50	2.18	2.33	.32	.17
1957	10.8	11.0	1.19	46.8	2.64	1.24	2.43	2.07	2.20	.36	.23
1958	10.6	9.6	1.02	47.3	2.82	1.33	2.35	2.00	2.12	.35	.23
1959	11.0	8.3	.91	46.5	2.77	1.29	2.20	1.96	2.07	.24	.13
1960	11.0	11.2	1.23	47.0	3.00	1.41	2.64	2.13	2.53	.51	.11
1961	10.9	9.7	1.06	47.2	31.1	1.47	2.53	2.28	2.41	.25	.12
1962	10.7	8.8	.94	46.9	3.57	1.67	2.61	2.34	2.50	.27	.11
1963	10.9	8.4	.92	48.0	3.58	1.72	2.64	2.51	2.59	.13	.05
1964 2/	10.9	11.2	1.22	47.8	3.48	1.66	2.88	2.66	2.81	.22	.07

1/ Simple average price per pound using the following quotations: Soybean oil, crude, tank cars, f.o.b. Decatur; soybean meal, bulk, Decatur, quoted as 41 percent prior to July 1950, 44 percent beginning July 1950.

2/ Preliminary.

earlier, capacity grew from 310 million to 600 million bushels in the same period. During the entire period, the ratio of utilized capacity (crushings) to total capacity has averaged about 80 percent (table 30).

Excess (or unused) processing capacity for the industry as a whole has averaged an estimated 20 percent since 1951. Excess processing capacity, as used here, means the difference between the estimated capacity and the quantity of soybeans actually crushed. For instance, during the 1964-65 processing season, the estimated crushing capacity was 585 million bushels of soybeans. Since only 479 million bushels actually were crushed, the indicated excess processing capacity was 106 million bushels or 18 percent.

Annual Crush Per Mill Increasing

The number of mills processing soybeans declined from 193 to 124 in 1965, a decrease of 69 mills or approximately 36 percent. But at the same time, average annual processing volume per mill increased from 1.3 million bushels in 1951 to 4.2 million in 1965, or by about 225 percent (table 30). By operating on a large scale, plants are able to take advantage of savings arising from both the processing of the soybeans and the marketing of the products.

Soybean processing plants are of course concentrated in the main areas of soybean production. In 1954, about two-thirds of the 162 active soybean mills in the United States were located in the soybean-corn belt States and one-third outside this region--the Plains States, lower Mississippi Valley, Middle Atlantic States, and the Southeast. By 1965, however, the 124 soybean processing mills were about equally distributed between the central soybean-corn belt States and the other areas. This reflects the rapid increase in soybean acreage and production in areas outside the central States.

Proportion of Soybean Crop Crushed Declines as Exports Expand

In 1953, about 81 percent (218 million bushels) of the soybean crop (269 million bushels) was processed at domestic soybean oil mills and 15 percent (40 million bushels) was exported as beans (table 32). Since then, the volume of domestically processed soybeans has increased at an average annual rate of about 8 percent, while the volume of soybean exports grew about 16 percent annually. In 1965, an estimated 60 percent (515 million bushels) of the soybean crop (853 million bushels) will be processed domestically and 27 percent (230 million bushels) will be exported as beans. In recent years, planting seed has accounted for about 5-6 percent of the total soybeans produced annually.

The sharp increases in soybean exports have been to Japan, Canada, and the industrialized countries of Western Europe. As a group these countries account for around 90 percent of the U. S. annual exports. In Canada and Europe, soybeans are usually crushed for meal and oil. Increased processing capacity and expanding markets, especially for meal, reflect the higher standards of living in these countries and this has stimulated exports.

Table 32.--Soybeans: Production, disposition, and value of products, year beginning September 1, 1953-65

Year beg. Sept. 1	Disposition 1/							Value of products per bushel of soybeans crushed 2/				
	Crushings			Exports		Seed		Soybean Oil (crude)	Soybean Meal (bulk)	Total	Percentage distribution	
	Production	Actual	% of production	Actual	% of production	Actual	% of production				Oil	Meal
	Mil. bu.	Mil. bu.	Pct.	Mil. bu.	Pct.	Mil. bu.	Pct.	Dol.	Dol.	Dol.	Pct.	Pct.
1953	269.2	217.8	81	40.1	15	22.9	8	1.47	1.85	3.32	44	56
1954	341.1	241.4	71	57.3	17	23.4	7	1.33	1.40	2.73	49	51
1955	373.7	281.9	75	68.6	18	25.8	7	1.39	1.24	2.63	53	47
1956	449.3	313.6	70	83.7	19	26.4	6	1.38	1.12	2.50	55	45
1957	483.4	350.9	73	88.4	18	29.5	6	1.19	1.24	2.43	49	51
1958	580.2	398.8	69	105.0	18	27.4	5	1.02	1.33	2.35	43	57
1959	532.9	394.0	74	139.9	26	29.3	5	.91	1.29	2.20	41	59
1960	555.3	406.1	73	134.7	24	32.9	6	1.23	1.41	2.64	47	53
1961	679.6	431.4	63	149.4	22	33.5	5	1.06	1.47	2.53	42	58
1962	669.2	472.7	71	180.5	27	34.4	5	.94	1.67	2.61	36	64
1963	699.4	436.8	62	187.2	27	36.5	5	.92	1.72	2.64	35	65
1964	699.9	479.0	68	212.2	30	39.4	6	1.22	1.66	2.88	42	58
1965 3/	852.7	515	60	230	27	40.0	5					

1/ Disposition totals for individual years may exceed production due to stock changes.

2/ See table 31 for method of computing.

3/ Production indicated November 1. Disposition is forecast.

Table 33.--Soybean oil and meal: Production and disposition, and bean equivalent of exports, year beginning September 1, 1953-65

Year beg. Sept. 1	Soybean Oil						Soybean Meal					
	Disposition 1/					Bean Equiv. 2/	Disposition 1/					Bean Equiv. 2/
	Domestic Use		Exports		Domestic Use		Exports					
	Production	% of production	Actual	% of production	Production		% of production	Actual	% of production			
	Mil. lb.	Mil. lb.	Pct.	Mil. lb.	Pct.	Mil. bu.	1,000 tons	1,000 tons	Pct.	1,000 tons	Pct.	Mil. bu.
1953	2,399	2,369	99	77	3	7	5,162	5,056	98	73	1	3
1954	2,630	2,585	98	49	2	4	5,534	5,368	97	247	4	11
1955	3,128	2,582	83	483	15	44	6,516	6,042	93	397	6	17
1956	3,408	2,494	73	856	25	78	7,452	7,052	95	452	6	19
1957	3,774	3,023	80	728	19	66	8,210	7,921	96	300	4	13
1958	4,224	3,278	78	899	21	82	9,434	8,921	95	496	5	21
1959	4,337	3,352	77	1,058	24	96	9,170	8,537	93	640	7	28
1960	4,465	3,292	74	719	16	65	9,538	8,847	93	606	6	26
1961	4,709	3,556	76	1,218	26	111	10,161	9,217	91	1,042	10	44
1962	5,079	3,712	73	1,145	23	104	11,095	9,579	86	1,439	13	61
1963	4,769	3,903	82	1,124	24	102	10,488	9,082	87	1,466	13	59
1964	5,215	4,097	79	1,361	26	124	11,439	9,328	81	2,084	18	87
1965	5,600	4,100	73	1,500	27	136	12,100	9,700	80	2,400	20	102

1/ Disposition totals for individual years may exceed production due to stock changes.

2/ Based on 11.0 pounds of oil and actual output of meal per bushel.

Table 34.--Soybeans, soybean oil, and soybean meal; U.S. exports as such and as oil and meal equivalent, year beginning September 1, 1953-65

Year beg. Sept. 1	Soybean exports			Soybean oil exports			Soybean meal exports		
	Actual	Oil equivalent of soybeans 1/	Meal equivalent of soybeans 2/	Actual	Oil equivalent of soybeans 1/	Total oil equiv.	Actual	Meal equiv. of soybeans	Total meal equiv.
	Mil. bu.	Mil. lb.	1,000 tons	Mil. lb.	Mil. lb.	Mil. lb.	1,000 tons	1,000 tons	1,000 tons
1953	40.1	441	951	77	441	518	73	951	1,024
1954	57.3	630	1,315	49	630	679	247	1,315	1,562
1955	68.6	754	1,584	483	754	1,237	397	1,584	1,981
1956	83.7	921	1,989	856	921	1,777	452	1,989	2,441
1957	88.4	972	2,068	728	972	1,700	300	2,068	2,368
1958	105.0	1,155	2,483	899	1,155	2,054	496	2,483	2,979
1959	139.9	1,539	3,253	1,058	1,539	2,597	640	3,253	3,893
1960	134.7	1,481	3,165	719	1,481	2,200	606	3,165	3,771
1961	149.4	1,644	3,526	1,218	1,644	2,862	1,042	3,526	4,568
1962	180.5	1,985	4,232	1,145	1,985	3,130	1,439	4,232	5,671
1963	187.2	2,060	4,494	1,124	2,060	3,184	1,416	4,494	5,910
1964	212.2	2,334	5,071	1,361	2,334	3,689	2,084	5,071	7,155
1965	230	2,525	5,400	1,500	2,525	4,025	2,400	5,400	7,800

1/ Based on 11.0 pounds of oil per bushel of soybeans.

2/ Based on actual output of meal per bushel of soybeans.

About one-half the soybeans used in Japan go directly into human foods, since many traditional Oriental foods include soybeans as an ingredient. The remainder is processed for oil and meal.

Domestic Use of Soybean Oil Now Accounts for 75 Percent of Output

Annual domestic disappearance of soybean oil currently accounts for about 75 percent of the soybean oil produced in the United States, and exports about 25 percent (table 33). Prior to the enactment of P.L. 480 in 1954, a law which authorized Government-financed exports of edible oil to underdeveloped nations, the proportion of soybean oil used at home was considerably greater.

During 1953-65, domestic disappearance showed a steady uptrend from 2.4 billion pounds to 4.1 billion. Soybean oil is used mainly in food products (about 93 percent of total domestic use) such as margarine, shortening, salad and cooking oils, and mayonnaise and salad dressings. Domestic usage of soybean oil has increased at a rate faster than population growth and has replaced other fats and oils formerly used in greater volume.

Soybean oil exports increased from 77 million pounds in 1953 to the projected 1.5 billion pounds for 1965-66. This reflects the heavy shipments under the Food-for-Peace Program (P.L. 480) as well as an expansion in dollar exports. Approximately 60 percent of soybean oil exports as such in the 1954-65 period were shipped under the Food-for-Peace Program. Each year since the beginning of the program in 1954, edible vegetable oils (soybean and cottonseed oils) have been designated as a surplus commodity available for export for foreign currencies under P.L. 480.

As may be seen in table 34, total soybean oil exports, when including the oil equivalent of exported soybeans, increased from 0.5 billion pounds in 1953 to an estimated 4.0 billion in 1965. On this overall oil and oil equivalent basis over 75 percent of soybean oil exports are for dollars and less than 25 percent under programs.

Soybean Meal Exports Increasing Rapidly

Domestic use of soybean meal has increased from 5.1 million tons (98 percent of total U.S. production) in 1953-54 to 9.7 million tons (80 percent of production) estimated for 1965-66. Domestic use of soybean meal is almost exclusively for feed. The largest portion of soybean meal use has been in poultry feeds, although the biggest increase in consumption recently has been in hog feeds. Factors primarily responsible for the rapid expansion of U.S. soybean meal consumption have been increasing livestock numbers, increased feeding of high protein concentrates per animal unit, and the rapid expansion of the mixed feed industry.

Soybean meal exports increased from 73,000 tons in 1953 to the 2.4 million tons projected for 1965-66. Between 1953 and 1960, soybean meal exports averaged only about 5 percent of total production. Since 1960, however, exports of soybean meal have been increasing rapidly, reaching a level of about 20

percent of production in 1965. Rising animal numbers in foreign nations, especially Western Europe, and growing acceptance of vegetable protein in livestock rations and the high-quality of U.S. toasted soybean meal have contributed to this increase.

While soybean meal exports in meal form have expanded sharply in recent years, most U.S. meal is still exported in the form of soybeans (table 34). During the 1965-66 marketing year, an estimated 7.8 million tons of soybean meal (including the meal equivalent of 230 million bushels of soybeans) will be exported. Of this total, 2.4 million tons or 31 percent is expected to move abroad as meal whereas 5.4 million tons or 69 percent will move in the form of soybeans.

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